AUTOMATED TEST AND ALIGNMENT UNIT (ATAU), 628450

GENERAL DESCRIPTION

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1. GENERAL

1.01 This Section provides a general description of the ITT D448 automated test and alignment unit (ATAU), 628450 (Fig. 1), to the functional block diagram level.

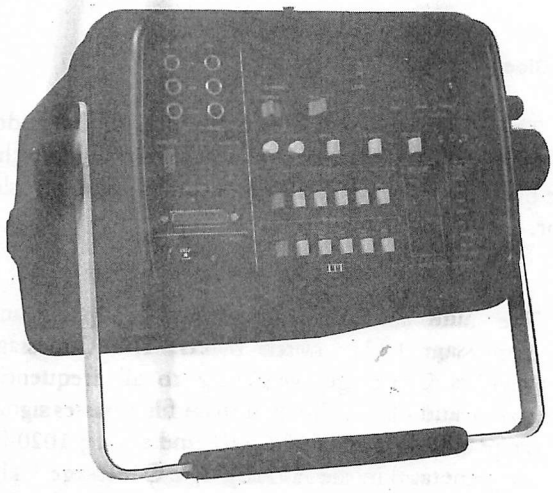

Fig. 1—ATAU, 628450

1.02 This Section has been reissued to include information on testing special service channel units.

1.03 The ATAU is used to perform alignment, testing, and trouble location on the D448 channel units on either a single-ended or end-to-end basis. Single-ended testing can be used with the multiplex terminal either in or out of service. In single-ended testing, the ATAU is connected to the channel unit under test [voice frequency (VF) interface] and the test interface unit (TIU), 628455, [pulse code modulation (PCM) interface]. Although the ATAU is primarily used with the D448 multiplex terminal, it can also be used in other applications as a single-frequency oscillator (1020 Hz) or level meter.

2. DESCRIPTION

2.01 The ATAU is a self-contained, stand-alone piece of test equipment mounted in a portable carrying case. The dual purpose handle serves as a carrying handle and as a front-base support for positioning the front panel at a convenient viewing angle. Controls and indicators are located on the front panel. The unit name is also located on the front panel. The part number and serial number are located on the rear of the unit. The front cover of the unit provides storage for test cords and the line cord. The line cord plugs into a socket on the bottom of the case.

3. FUNCTIONAL OPERATION (FIG. 2)

BLOCK DESCRIPTIONS

3.01 The hybrid provides the circuitry necessary for making transhybrid measurements on the channel unit under test (CUUT) for the balance test.

3.02 The signaling circuit is used to check for proper channel unit signaling and to identify the channel unit type for display on the front panel. The signaling circuit works in conjunction with the time slot selector, PCM transmit (TX) circuit, and PCM receive (RX) circuit.

3.03 The impedance matching circuit provides the circuitry necessary to match the ATAU to channel unit impedances of 150, 600, 900, or 1200 ohms.

3.04 The variable level generator (VLG) provides 1020-Hz signals from +9.9 to −69.9 dB in 0.1-dB steps. The level can be varied either automatically by the control circuit (single-ended operation) or manually by the TX LEVEL thumbwheel switches (end-to-end operation).

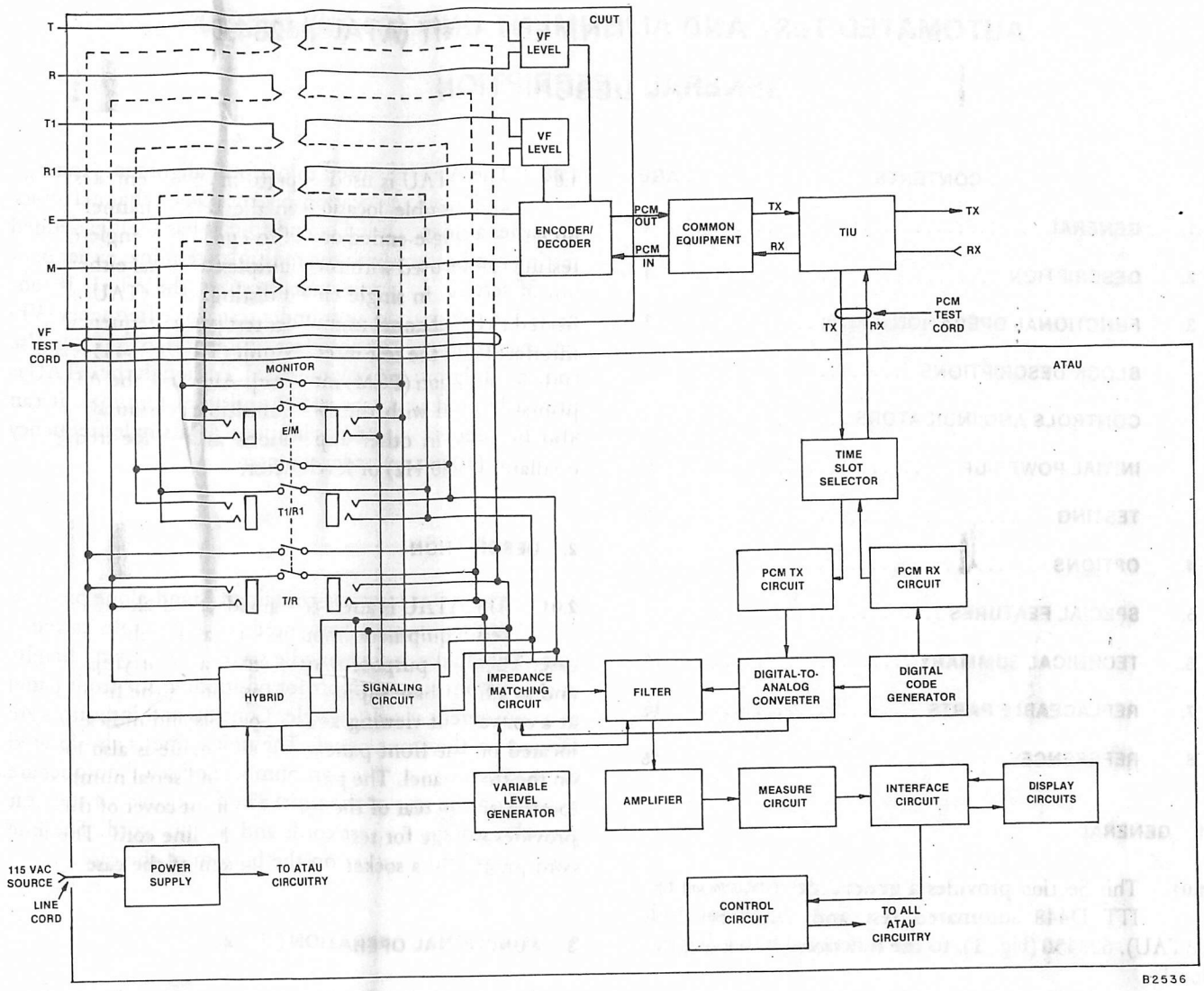

Fig. 2—ATAU, 628450, Functional Block Diagram

3.05 The digital-to-analog converter (DAC) converts digital words presented to it by the PCM TX circuit and the digital code generator into analog levels which can then be measured.

3.06 The PCM TX circuit and PCM RX circuit interface the ATAU with the digital bit stream from the common equipment. Data is extracted from the transmit bit stream or inserted into the receive bit stream at the time period corresponding to the CUUT time slot under control of the time slot selector.

3.07 The time slot selector chooses the proper time slot in the transmit and receive bit streams for the CUUT.

3.08 The digital code generator produces digital codes for various analog levels which are inserted into the receive bit stream via the PCM RX circuit and the time slot selector.

3.09 The unit contains C-message, bandpass, and C-message 1-kHz notch filters. The C-message filter provides C-message weighting to all frequencies between zero and 4 kHz. The bandpass filter passes signals in the range of 1 kHz (digital 1-kHz and analog 1020-Hz signals are generated in the ATAU). The C-message 1-kHz notch filter attenuates signals in the range of 1 kHz while providing C-message weighting to other frequencies. Generally, the filter provides the circuitry used in the VF

level, tracking, signal-to-distortion, idle channel noise, and end-to-end crosstalk tests.

3.10 The amplifier controls the amplitude of the signals it receives from the filter to ensure the proper input level to the measure circuit. In effect, the amplifier provides variable gain so that nearly any level signal can be measured.

3.11 The measure circuit measures the output level of the amplifier and provides appropriate control signals to bring the amplifier back into range should the output of the amplifier exceed a predetermined amplitude range.

3.12 The control circuit contains an 8035 microprocessor and program memory for controlling ATAU operation. It coordinates all test functions selected by the user when the ATAU is in the automated mode of operation.

3.13 The interface circuit conditions inputs for the control circuit and buffers output signals for user feedback. It accepts the outputs from the measure circuit and forwards the data to the display circuits. It also reads the switches on the front panel (display circuits) and forwards the data to the control circuit.

3.14 The display circuits consist of all controls and indicators and their associated circuitry. The display circuits provide for user input and feedback (via LEDs and the displays).

3.15 The power supply contains a switching regulator and provides the necessary power for the ATAU from a 115-Vac power source.

CONTROLS AND INDICATORS

3.16 The controls and indicators on the ATAU front panel are described in Table A. The locations of these items are shown in Fig. 1. These controls and indicators make up the display circuits.

TABLE A

CONTROL/INDICATOR	FUNCTION
EQUIP and LINE T/R, E/M, and T1/R1 Jacks	Provide access to line and equipment side of CUUT via VF test cord.
REMOTE Connector	Connector for hand-held remote control unit.

TABLE A (CONT)

CONTROL/INDICATOR	FUNCTION
CHANNEL Connector	Connector for VF test cord (ATAU-to-CUUT).
CHANNEL MONITOR ON/ OFF Switch	In ON position, allows monitoring CUUT without interrupting the circuit (overrides the lifting function of the splitting card jack by bridging the line and equipment sides of the jack); in OFF position, splitting card jack lifting function is provided via VF test cord.
SEQUENCE D1D, D2, D3 LEDs	Indicate optional channel sequencing format of terminal.
TIU Connector	Connector for PCM test cord (ATAU-to TIU).
POWER Switch and LED	The switch completes the circuit from the 115-Vac power source to the ATAU power supply; LED turns on when power is applied to ATAU.
CHANNEL Indicator (Digital Display)	Displays channel number (1 through 24) selected for testing (CUUT).
DIGROUP A/B Switch	Selects digroup associated with CUUT.
SELECT + / – Switch	Selects CUUT; in + (momentarily), increases CHANNEL number displayed by one; in + (held), increases CHANNEL number displayed by six per second; in –, decreases CHANNEL number displayed as described for + position.
LEVEL Indicator (Digital Display)	Displays level of test results.
TX LED	Turns on to indicate transmit tests are being performed or displayed.
RX LED	Turns on to indicate receive tests are being performed or displayed.

TABLE A (CONT)

CONTROL/INDICATOR	FUNCTION
DB, DBM, DBRNC, and DBNRC0 LEDs	One only turns on to define the unit of measurement being displayed on LEVEL indicator; in balance test, no LEDs are on, indicating dBm0 as the unit of measurement.
TEST START Button	Initiates test sequence.
TEST STEP Button	The ATAU automatically pauses to display test results; button advances the ATAU to the next procedure in the test sequence.
MANUAL Button	Inhibits full automated operation of the ATAU; allows for stepping through each test procedure and reading results on LEVEL display.
F-E BUSY Button	When pressed in single-ended testing, busies out far-end channel unit to prevent access of the channel.
END-END Button	Prepares ATAU to operate in the end-to-end mode; in this mode, the ATAU serves as a level meter or 1020-Hz oscillator.
TX LEVEL Thumbwheel Switches	Used to set transmit level (absolute) of 1020-Hz test tone from +9.9 to −69.9 dBm for input to CUUT for transmission to the far end in end-to-end testing.
TEST SELECT SIG (signaling), LEV (VF level), TRK (tracking), S/D (signal-to-distortion), ICN (idle channel noise), and BAL (balance) Buttons and LEDs	When pressed, selects which tests are to be performed; associated LED turns on while that test is in progress. ***Note 1:*** BAL button has dual function. In single-ended testing, it selects balance test. In end-to-end testing, it sets ATAU for crosstalk test.

TABLE A (CONT)

CONTROL/INDICATOR	FUNCTION
TEST SELECT SIG (signaling), LEV (VF level), TRK (tracking), S/D (signal-to-distortion), ICN (idle channel noise), and BAL (balance) Buttons and LEDs (Cont)	***Note 2:*** If TERMINATION AUTO button is pressed, the SIG button should not be used for special service channel units. Signaling can be performed with special service channel units with selection of proper termination. ***Note 3:*** If SIG and a TERMINATION button are not both pressed, or if TERMINATION AUTO button is pressed without SIG, all TEST SELECT LEDs will flash, indicating an improper test setup.
TERMINATION AUTO Button	When pressed in conjunction with SIG button, the ATAU automatically assigns appropriate termination for testing purposes; assumes impedance of 900 ohms for 2-wire channel units and 600 ohms for 4-wire channel units.
TERMINATION 2W600, 2W900, 4W150, 4W600, and 4W1200 Buttons	Press appropriate button for CUUT when impedance of CUUT is known or differs from that assumed by AUTO button; these buttons override any termination determined automatically during the signaling test.
NBO CAP 64, 32, 16, 8, 4, and 2 LEDs	During balance test, appropriate LEDs turn on to indicate an optimized transhybrid loss setting; CUUT should have identical NBO options selected to match the indicated transhybrid loss.
CHAN TYP 2WEM, 4WEM, DPO, DPT, 2WFXO, and 2WFXS LEDs	One only turns on during signaling test to indicate type of CUUT.

INITIAL POWER-UP

3.17 When the ATAU is first powered up and connected to the CUUT and TIU, the ATAU performs as follows:

(a) A complete self-test of the ATAU is performed. Selected LEDs and the CHANNEL and LEVEL displays are turned on and the digital code generator and VLG levels are verified.

(b) Interconnection to CUUT VF and signaling access points is provided. If the MONITOR switch is in the ON position, the bridging function of the channel unit splitting card jack is transferred to the ATAU CHANNEL connector.

(c) The time slot selector is programmed to select the proper channel unit time slot and the TIU is programmed by the ATAU to access the proper digroup. The ATAU is totally programmed for test execution. The ATAU implements appropriate termination for the CUUT type and impedance.

TESTING

A. General

3.18 The testing performed by the ATAU is under software control with tests selected by switch inputs to the control circuit.

3.19 Testing with the ATAU may be performed single-ended (either automated or manual) or end-to-end (manual only). Single-ended testing means analog-to-digital (transmit) and digital-to-analog (receive). Analog (VF) access is via the channel unit splitting card jack. Digital (PCM) access is provided by the TIU. Table B breaks down test usage.

TABLE B

TEST	SINGLE-ENDED	END-TO-END*
Signaling	Yes†	No
VF Level	Yes†	Yes
Tracking	Yes†	Yes
Signal-to-Distortion	Yes†	Yes
Idle Channel Noise	Yes†	Yes
Balance	Yes*	No
Crosstalk	No	Yes

*Manual operation only.
†Automated or manual operation.

3.20 For either single-ended or end-to-end testing, impedance matching may be selected for 2-wire and 4-wire channel unit types for 150, 600, 900, or 1200 ohms. Note that if TERMINATION AUTO is pressed, then the signaling test must be performed first. TERMINATION AUTO is used only for single-ended testing. After tests have been selected and a termination has been specified or the TERMINATION AUTO button pressed, pressing the START button begins the test. If single-ended manual or end-to-end testing is used, the STEP button must be pressed to proceed through the testing. If single-ended automated testing is used, test failure limits (TFL) are checked for the tracking, signal-to-distortion, and idle channel noise tests.

3.21 A TFL is a test requirement checked internally in the ATAU which the CUUT must meet. The action of the ATAU checking a TFL is basically the same as when the user in manual testing checks a printed test requirement to see if the CUUT passes a test.

3.22 Failure to meet a specific TFL is indicated by the LED for the failed test flashing. Pressing the STEP button causes the ATAU to proceed with the testing past the failure.

3.23 In single-ended testing, the tests are run from left-to-right as shown on the ATAU front panel. In end-to-end testing, each test must be performed separately.

B. Single-Ended Testing

Signaling Test (Fig. 3)

3.24 The signaling test identifies and performs functional signaling checks of the seven most common channel unit types (2-wire E&M, 4-wire E&M, 2-wire dial pulse originating, 3-wire dial pulse originating, dial pulse terminating, 2-wire foreign exchange office, and 2-wire foreign exchange subscriber). The signaling circuit has access to the channel unit T, R, T1, R1, E and M leads (T1 and R1 on 4-wire channel units only); and the PCM TX and PCM RX circuits have access to the transmit and receive signaling highways via the time slot selector. The signaling test consists of two phases. The first phase is channel unit identification. When the channel unit type is identified, the channel type is indicated by the CHAN TYP LEDs. Following identification, the ATAU performs a test for the specific channel unit identified in order to test the signaling circuitry of the channel unit.

3.25 The signal flow for the ATAU in the signaling test is shown in Fig. 3. In the first phase of the test, the

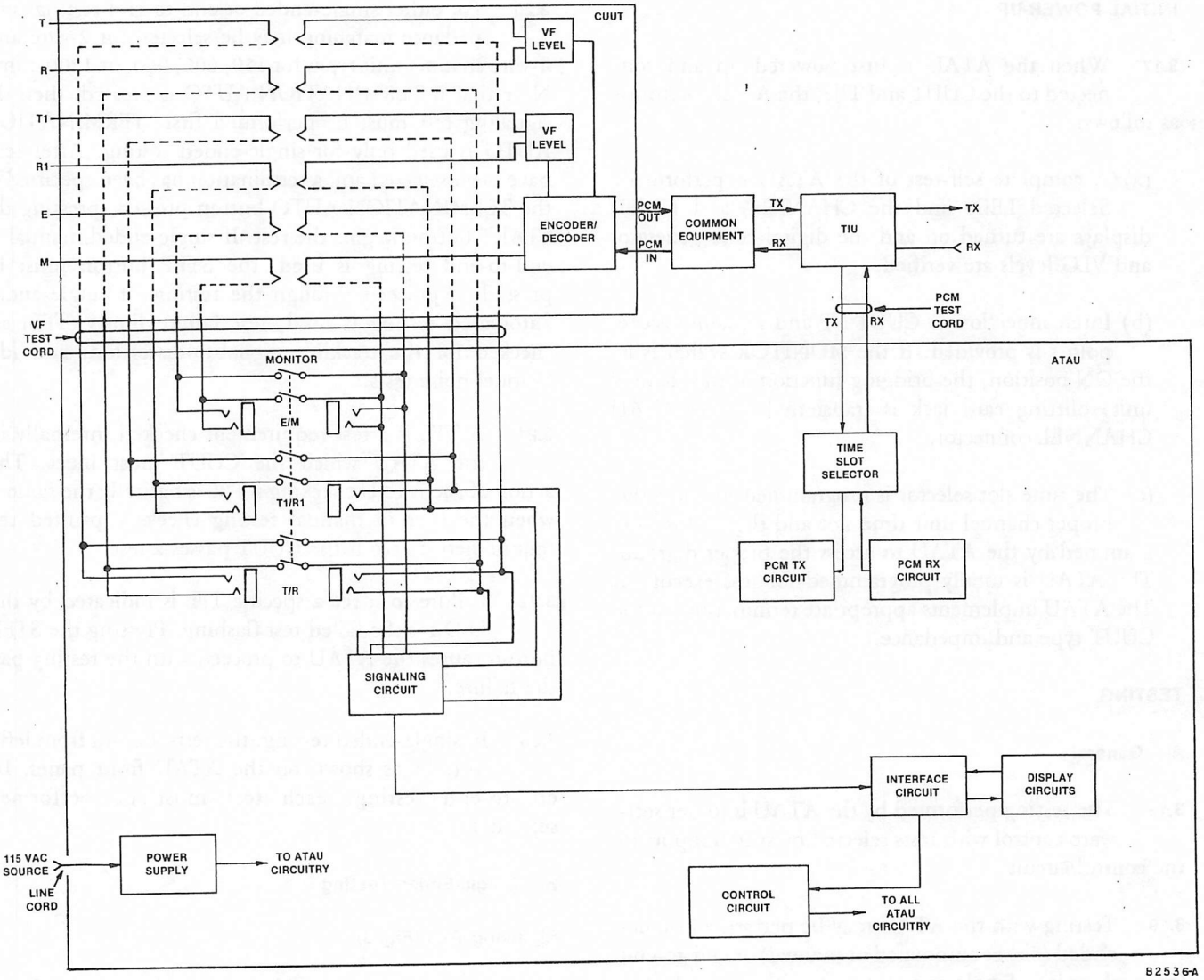

Fig. 3—Signal Flow Diagram for Signaling Test

time slot selector and PCM RX circuit insert signaling highway bits into the appropriate receive channel for the CUUT. These bits cause the CUUT to be either busied or idled. The signaling circuit checks for the presence of the proper condition at the points it is monitoring on the CUUT. The signaling circuit then sets conditions at the CUUT line. These conditions are encoded by the CUUT and sent out in the digital bit stream for the CUUT. The time slot selector and PCM TX circuit monitor the CUUT transmit highway conditions. By using a series of busy and idle conditions, the signaling circuit makes an identification of the type of CUUT and provides a signal to the display circuits via the interface circuit, which causes the display circuits to turn on the appropriate CHAN TYP LED on the front panel.

3.26 In the second phase of the test, the signaling circuitry check, the ATAU basically performs as described in Para. 3.25 except that it is creating and checking additional conditions for the specific type of channel unit identified and displayed. The procedure described in Para. 3.25 checks CUUT signaling for identification only. To completely check the CUUT signaling, the signaling circuit sequentially sets conditions for all possibilities for transmit and receive signaling. During testing of foreign exchange subscriber channel units, the ringing is also checked. If the CUUT performs as designed, the ATAU proceeds through the test without interruption. However, if any of the signaling circuitry checks fail, the ATAU stops the test sequence and the display circuits cause the SIG LED to flash, indicating a failure.

3.27 If the TERMINATION AUTO button is pressed when the signaling test is run, a termination for the VF tests is selected by the ATAU. If a 2-wire channel unit is identified, the termination selection is made for 900 ohms; if a 4-wire channel unit is identified, the termination selection is made for 600 ohms. If a channel unit with other than the above impedances is tested, the proper termination should be selected prior to running the signaling test. For the termination selection, the front panel selected termination has precedence over the signaling test determined termination. The termination determined by the signaling test is only used when the TERMINATION AUTO button has been pressed.

3.28 The ATAU will not identify special service channel units with the AUTO-SIG test sequence. The user must manually press required TERMINATION button, and then set the ATAU to the appropriate signaling bits before additional tests can be performed. The user must set the signaling bits so that the signaling highway is conditioned to initiate an active transmission path through the RX side of the CUUT. This is done by selecting an "*" on the far left thumbwheel switch and either a logical 0 or 1 on the other two switches. Refer to Section ITTR-18-443 for details.

VF Level Test (Fig. 4 and 5)

3.29 The VF level test displays the analog line level corresponding to the 0-dBm0 PCM reference level on receive and transmit for the CUUT. The signal flow for the ATAU in the receive VF tests is shown in Fig. 4. A calibrating routine is performed during the receive side

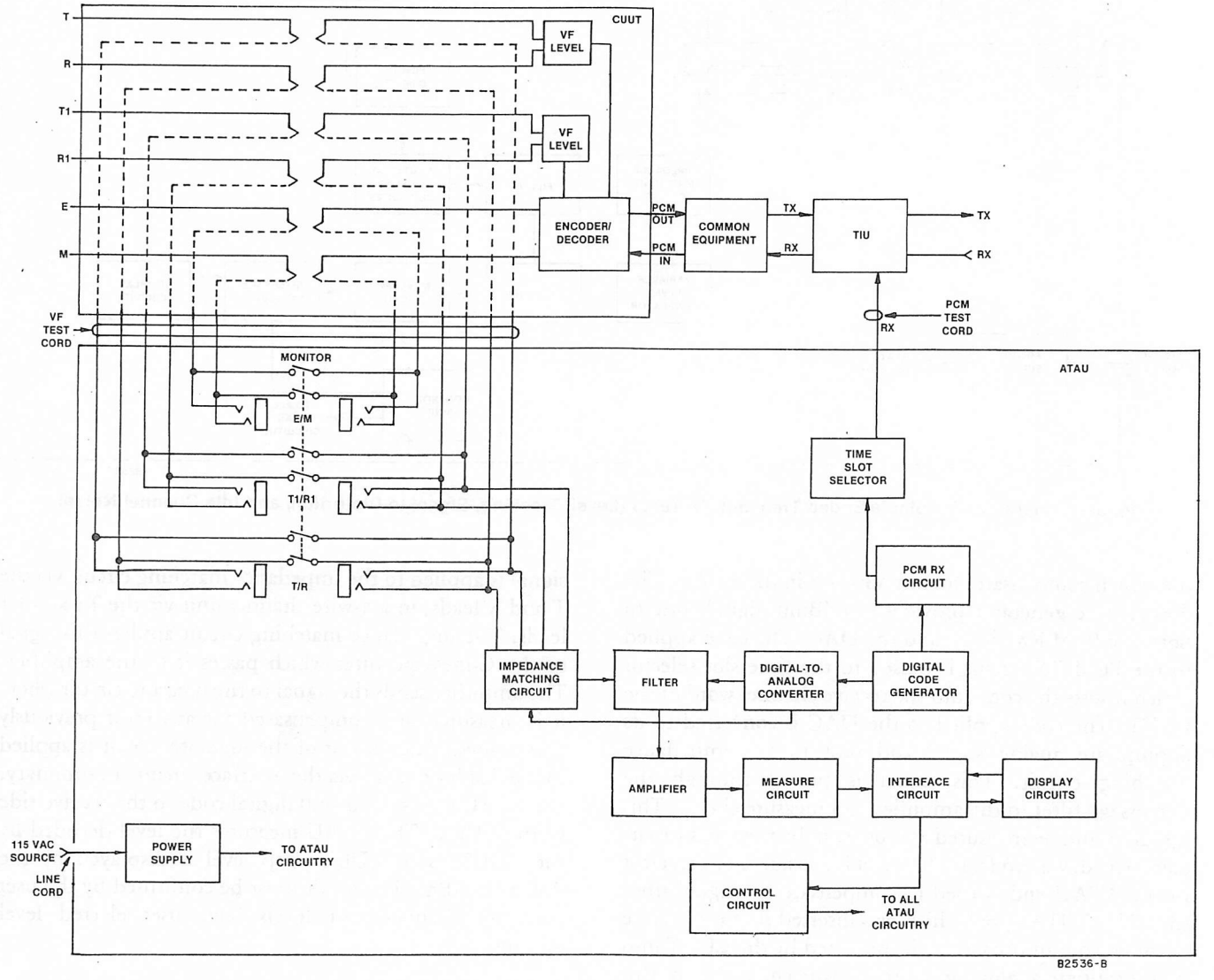

Fig. 4—Signal Flow for Single-Ended Receive VF Tests (Level, Tracking, Signal-to-Distortion, and Idle Channel Noise)

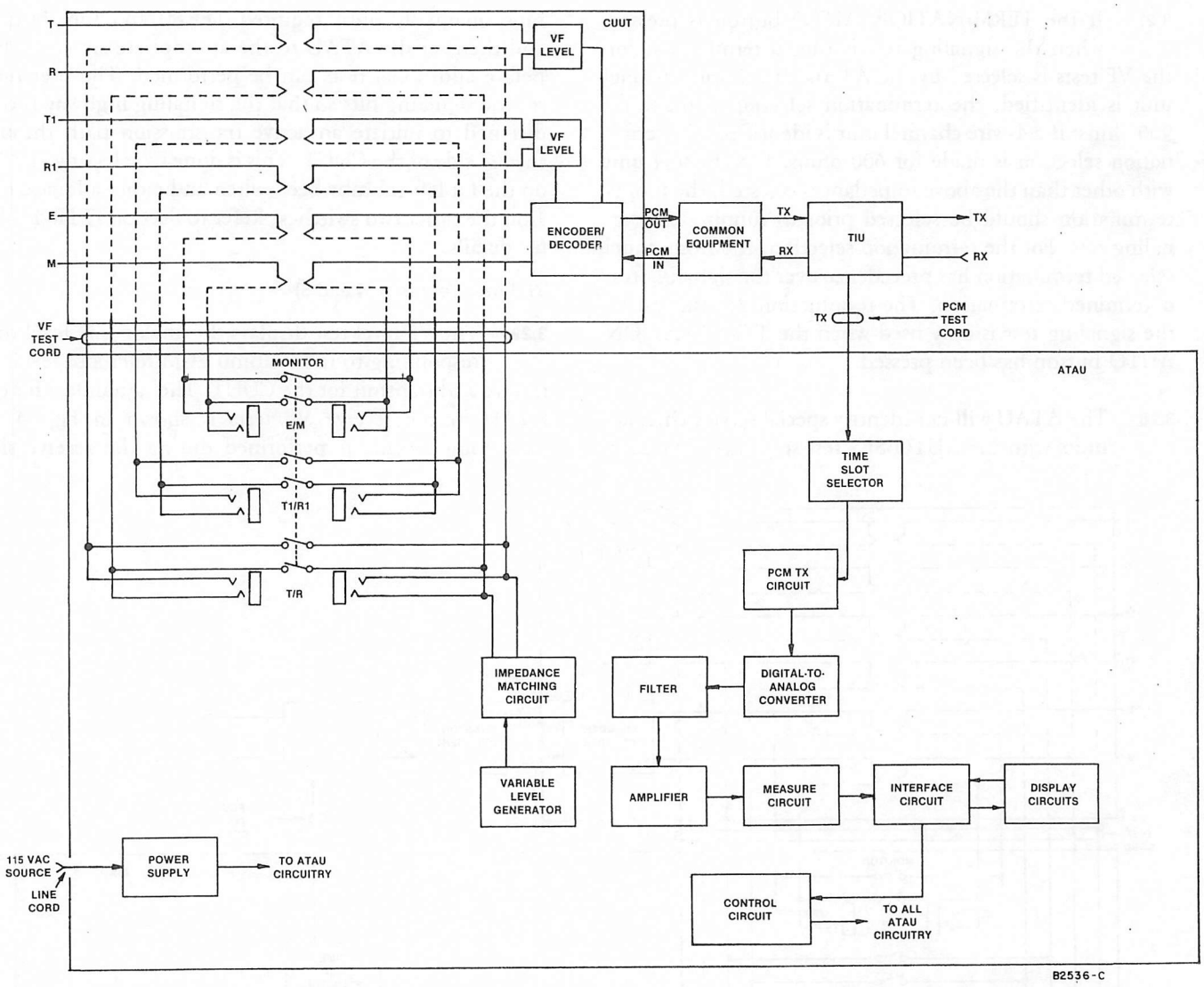

Fig. 5—Signal Flow for Single-Ended Transmit VF Tests (Level, Tracking, Signal-to-Distortion, and Idle Channel Noise)

test which compensates for any VF error in the ATAU. The digital code generator provides a 0-dBm0 digital code to both the PCM RX circuit and the DAC. The code applied to the PCM RX circuit is passed to the time slot selector which inserts the code into the receive channel word of the CUUT. The code applied to the DAC is converted to its appropriate analog signal and sent to the impedance matching circuit. This signal is passed through the C-message filter to the amplifier and measure circuit. This signal should be measured as 0.00 dBm by the measure circuit. Any deviation from this level is considered as an error in the ATAU and is used to compensate the signal from the CUUT. The signal which was inserted into the receive channel word of the CUUT is converted by the CUUT into its appropriate analog signal. In a 2-wire channel unit, this signal is applied to the impedance matching circuit via the T and R leads; in a 4-wire channel unit via the T1 and R1 leads. The impedance matching circuit applies this signal to the C-message filter which passes it to the amplifier. The amplifier sends the signal to the measure circuit where it is measured and compensated for any error previously determined. The output of the measure circuit is applied to the display circuits via the interface circuit. In summary, the ATAU sends a 0-dBm0 digital code to the receive side of the CUUT. The ATAU measures the level decoded by the CUUT. This CUUT drop level is displayed by the ATAU in dBm. The result must be confirmed by the user since all channel unit levels have user-selected level options.

3.30 The signal flow for the ATAU in the transmit VF tests is shown in Fig. 5. For the transmit side of the level test, the 0-dBm0 PCM reference level is checked. A VF level of −20 dBm at 1020 Hz from the VLG is passed through the impedance matching circuit to the transmit CUUT line. The CUUT encodes this signal and sends it out in the digital bit stream. The time slot selector extracts the signal from the transmit channel word of the CUUT and passes it through the PCM TX circuit to the DAC where it is converted to an analog signal. The signal is filtered by the C-message filter and applied to the measure circuit via the amplifier. If the measured level does not correspond to 0 dBm0, the deviation from 0 dBm0 is used to determine a new level for the VLG. The above process continues until the measured level corresponds to the 0-dBm0 PCM reference level. When this occurs, the transmit level from the VLG is displayed in dBm by the display circuits. The VF error determined in the receive side of this test is also used for compensation in the transmit test. In summary, the ATAU applies a VF signal to the CUUT. The ATAU decodes and measures the digital code transmitted by the CUUT. The output of the VLG is adjusted, under control of the microprocessor in the control circuit, until a 0-dBm0 level results in the PCM transmit of the CUUT. The ATAU then displays the VLG level in dBm which is required for the 0-dBm0 PCM transmit reference level. As in the receive test, the result must be confirmed by the user as matching the desired level as determined by channel unit level options.

3.31 The 0-dBm0 readings for either the receive or transmit tests are being taken continuously. Any user adjustments may be made as desired on a single-ended basis and the level settings are known immediately.

Tracking Test (Fig. 4 and 5)

3.32 The tracking test checks and/or displays receive and transmit levels at 0 through −40 dBm0. For receive testing, the signal flow is basically the same as described in Para. 3.29 and shown in Fig. 4, except that the ATAU error compensation is not made. The ATAU sends the digital codes for 0, −10, −20, −30, and −40 dBm0 to the CUUT via the TIU and common equipment. The ATAU measures the level decoded by the CUUT for each of the levels. In the automated mode, the ATAU displays the level in dBm and checks the results to TFL. The TFL for receive tracking is based on appropriate level changes (−10, −20, −30, and −40 dB) with respect to the 0-dBm0 PCM reference level. Since the TFL for receive tracking is always referenced to the level for 0 dBm0, it is valid, independent of channel unit level option settings. *In manual testing,* the ATAU displays the levels in dBm and the user must confirm that the results meet the test requirements.

3.33 For transmit testing, the signal flow is basically the same as described in Para. 3.30 and shown in Fig. 5, except that the ATAU error compensation is not made. The VLG applies a signal to the CUUT consistent with a 0-dBm0 PCM transmit reference level. The ATAU decodes and measures the digital code transmitted by the CUUT. The analog levels are then checked for appropriate level changes (−10, −20, −30, and −40 dB) from the reference 0-dBm0 level. Since the transmit tracking test is always referenced to the level (from the VLG) for 0 dBm0, it is valid, independent of channel unit level option settings. As in receive testing, the ATAU displays the levels in dBm and checks the results to TFL when operating in the automated mode. *In manual testing,* the ATAU displays the levels in dBm and the user must confirm that the results meet the test requirements.

Signal-to-Distortion Test (Fig. 4 and 5)

3.34 The signal-to-distortion test checks and/or displays the ratio for 0 through −40 dBm0 for receive and transmit. For receive testing, the signal flow is basically the same as described in Para. 3.29 and shown in Fig. 4, except that the ATAU error compensation is not made. The ATAU sends the digital codes for 0, −10, −20, −30, and −40 dBm0 to the CUUT via the TIU and the common equipment. The ATAU takes two measurements at each level; one for the signal level and one with C-message notch filtering for the distortion level. The ATAU calculates and displays the difference between the two measurements in dB. In the automated mode, the ATAU displays the ratio in dB and checks the results to TFL. *In manual testing,* the ATAU displays the ratio in dB and the user must confirm that the results meet the test requirements.

3.35 For transmit testing, the signal flow is basically the same as described in Para. 3.30 and shown in Fig. 5, except that the ATAU error compensation is not made. The VLG applies 0, −10, −20, −30, and −40 dBm0 to the CUUT. The ATAU decodes the digital codes transmitted by the CUUT. The resulting analog level is then measured twice; once for the signal level and once with C-message notch filtering for the distortion level. The ATAU calculates and displays the difference in dB between the two measurements. As in receive testing, the ATAU displays the ratio in dB and checks the results to TFL when operating in the automated mode. *In manual*

testing, the ATAU displays the ratio in dB and the user must confirm that the results meet the test requirements.

Idle Channel Noise Test (Fig. 4 and 5)

3.36 The idle channel noise test measures the CUUT noise and checks and/or displays the level. For receive testing, the signal flow is basically the same as described in Para. 3.29 and shown in Fig. 4, except that the ATAU error compensation is not made. The ATAU sends the digital code for 0 dBm0 to the CUUT via the TIU and common equipment. The ATAU measures the level decoded by the CUUT and stores it for reference. The ATAU now sends a digital quiet code to the CUUT via the TIU and common equipment. The ATAU measures the level decoded by the CUUT and compares it to the previous measurement. In the automated mode, the ATAU displays the difference in dBrnc0 and checks the result to TFL. *In manual testing,* the ATAU displays the noise level in dBrnc0 and the user must confirm that the result meets the test requirement.

3.37 For transmit testing, the signal flow is basically the same as described in Para. 3.30 and shown in Fig. 5, except that the ATAU error compensation is not made. The ATAU measures and decodes the digital code transmitted by the CUUT when the CUUT is terminated by the impedance matching circuit and has no input signal. The resulting noise level is measured by the ATAU. In the automated mode, the ATAU displays the noise level in dBrnc0 and checks the result to TFL. *In manual testing,* the ATAU displays the noise level in dBrnc0 and the user must confirm that the result meets the test requirement.

Balance Test (Fig. 6)

3.38 The balance test determines the network build-out capacitance (NBOC) necessary for maximum transhybrid loss at 1020 Hz. The optimum NBOC value is displayed on the NBO CAP LEDs and equivalent transhybrid loss readings are displayed. The signal flow for the ATAU in the balance test is shown in Fig. 6. The balance test must be performed with the ATAU in the manual mode and the CUUT must be terminated. The test is run in two phases. In the first phase, the VLG injects a 1020-Hz tone into the office equipment, via the hybrid, and the ATAU measures the returned level, via the hybrid, C-message filter, amplifier, and measure circuit. The ATAU varies internal NBOC while determining maximum transhybrid loss. The ATAU displays the value of NBOC necessary to get maximum transhybrid loss at 1020 Hz.

3.39 In the second phase of the test, the CUUT is reconnected to the office equipment and the ATAU applies the digital code for 0 dBm0 to the CUUT via the TIU and common equipment. The ATAU measures the returned level encoded by the CUUT. This analog level is displayed in dBm0. When the CUUT is used with the channel extender unit (CEU), 628460, the NBOC on the CUUT can be changed and the ATAU will continually update the displayed level.

3.40 The NBOC value indicated by the ATAU in the first phase of the test is the optimum build-out for the hybrid and NBO capacitors in the ATAU. The actual build-out needed for the CUUT may vary slightly from that indicated because of possible differences between the hybrids and between the NBO capacitors in the ATAU and CUUT. The setting determined in phase one of the test may be used for NBOC in most cases, but phase two testing may be performed where precise setting of the NBOC is desired.

C. End-to-End Testing (Fig. 7 and 8)

General

3.41 Testing performed end-to-end utilizes the ATAU as an oscillator at the transmitting end or as a level (noise or signal) meter at the receiving end. Signal flow for the ATAU at the transmitting end is shown in Fig. 7. Signal flow for the ATAU at the receiving end is shown in Fig. 8. To setup the ATAU for the transmitting end, the START and then STEP buttons are pressed. To setup the ATAU at the receiving end, only the START button is pressed. To reverse the functions, the ATAU at the transmitting end is changed to the receiving end by pressing the START button; the receiving end is changed to the transmitting end by pressing the STEP button.

Level Test

3.42 At the transmitting end, the VLG applies a 1020-Hz tone to the CUUT. The level is set by the TX LEVEL thumbwheel switches. The signal is sent to the receiving end. At the receiving end, the ATAU operates as a C-message weighted level meter. The received signal level is measured and displayed by the ATAU in dBm. The user must confirm that the result meets the test requirement.

Tracking Test

3.43 At the transmitting end, the ATAU performs as in the level test, except that each time the STEP

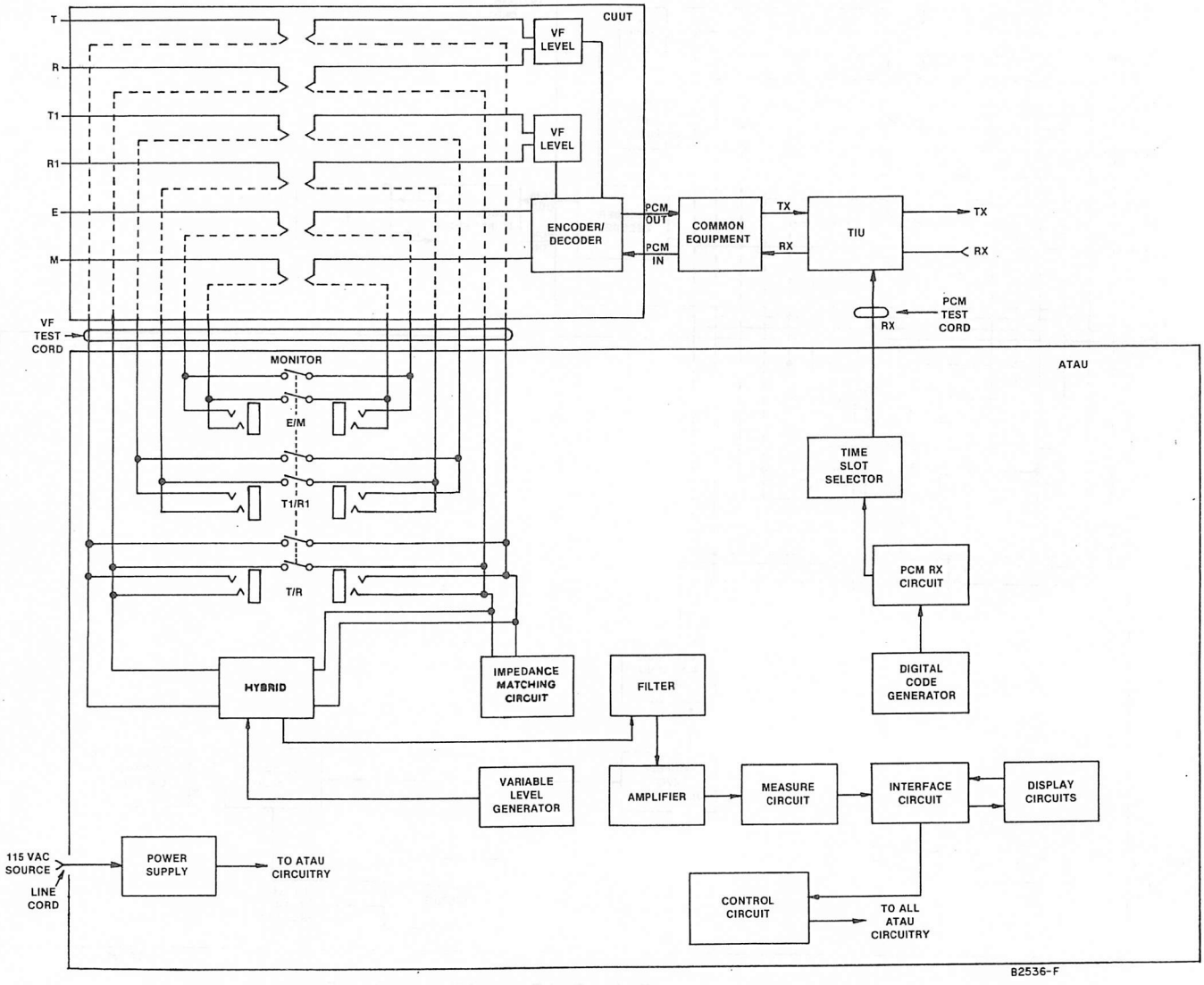

Fig. 6—Signal Flow for Balance Test

button is pressed, the transmitted signal is lowered by 10 dB (to a maximum of 40 dB). The function of the receiving-end ATAU is identical to that of the level test. The user must confirm that the results meet the test requirements.

Signal-to-Distortion Test

3.44 At the transmitting end, the ATAU performs as in the tracking test. At the receiving end, the ATAU first measures the received signal as a C-message weighted level meter. The measured level is stored. The receiving-end ATAU then measures the distortion level using a C-message notch filter. The two measurements are compared and the ratio is displayed in dB. The user must confirm that the results meet the test requirements.

Idle Channel Noise Test

3.45 At the transmitting end, the ATAU terminates the CUUT. At the receiving end, the ATAU measures any noise received by the CUUT. The noise level is displayed in dBrnc. The user must confirm that the result meets the test requirement.

Crosstalk Test

3.46 The crosstalk test is selected by pressing both the BAL and END-END buttons. An external gener-

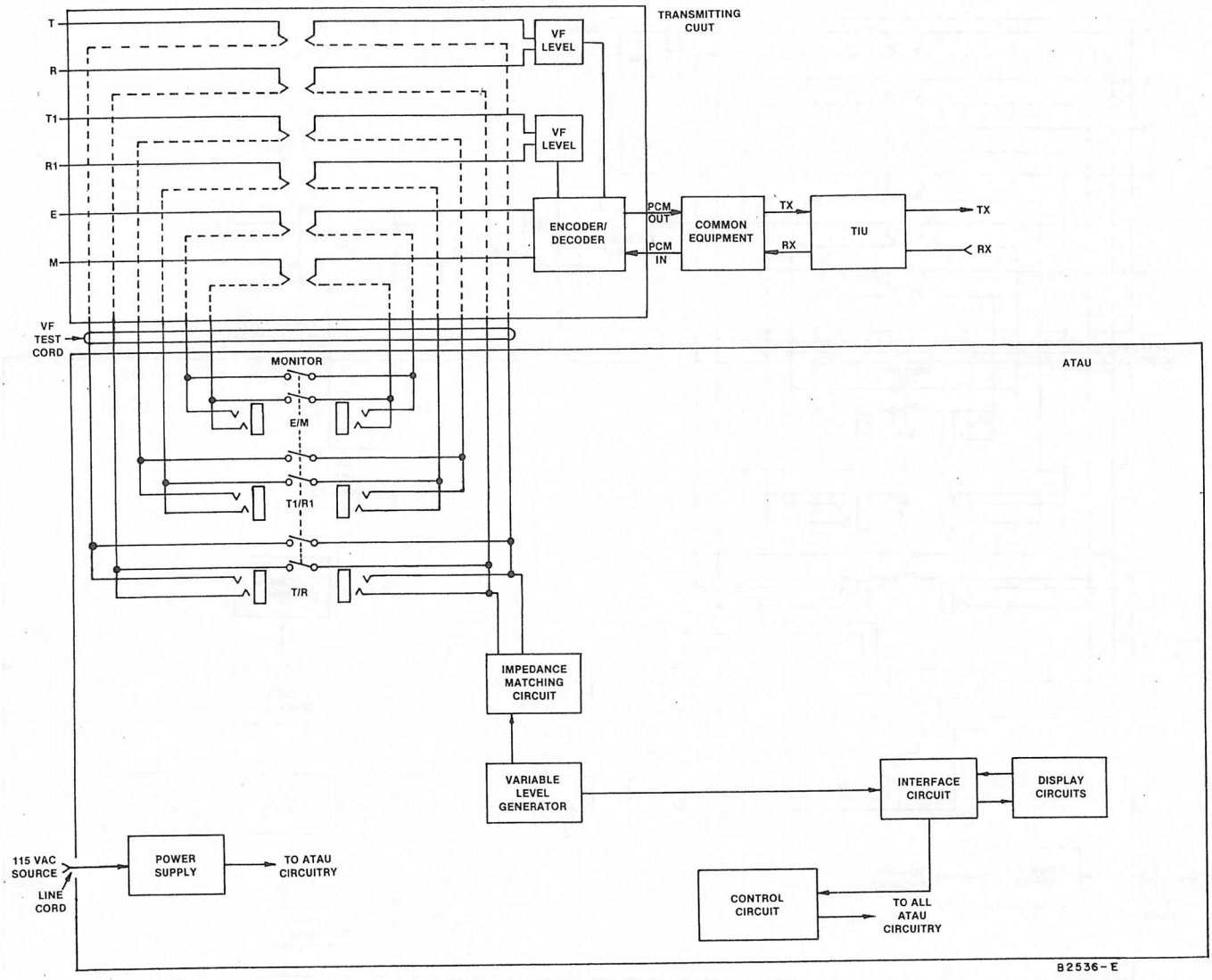

Fig. 7—Signal Flow for End-to-End Tests at Transmitting End

ator is used to inject a 1010-Hz tone into the most interfering channel unit (channel unit adjacent to CUUT) at the near end. The signal flow for the ATAU in the crosstalk test is shown in Fig. 8. The ATAU at the near end measures any signal present in the CUUT. The signal is filtered with bandpass and C-message filters before being displayed in dBm. The user must confirm that the result meets the test requirement.

4. OPTIONS

4.01 This unit has no field-selectable options.

5. SPECIAL FEATURES

5.01 The ATAU requires no preventive or routine maintenance other than the self-test the unit performs on each power-up.

5.02 The ATAU is compatible for use with all D448 multiplex terminals regardless of the mode of operation of the terminal.

5.03 The ATAU is completely automated with the option to perform in the manual mode.

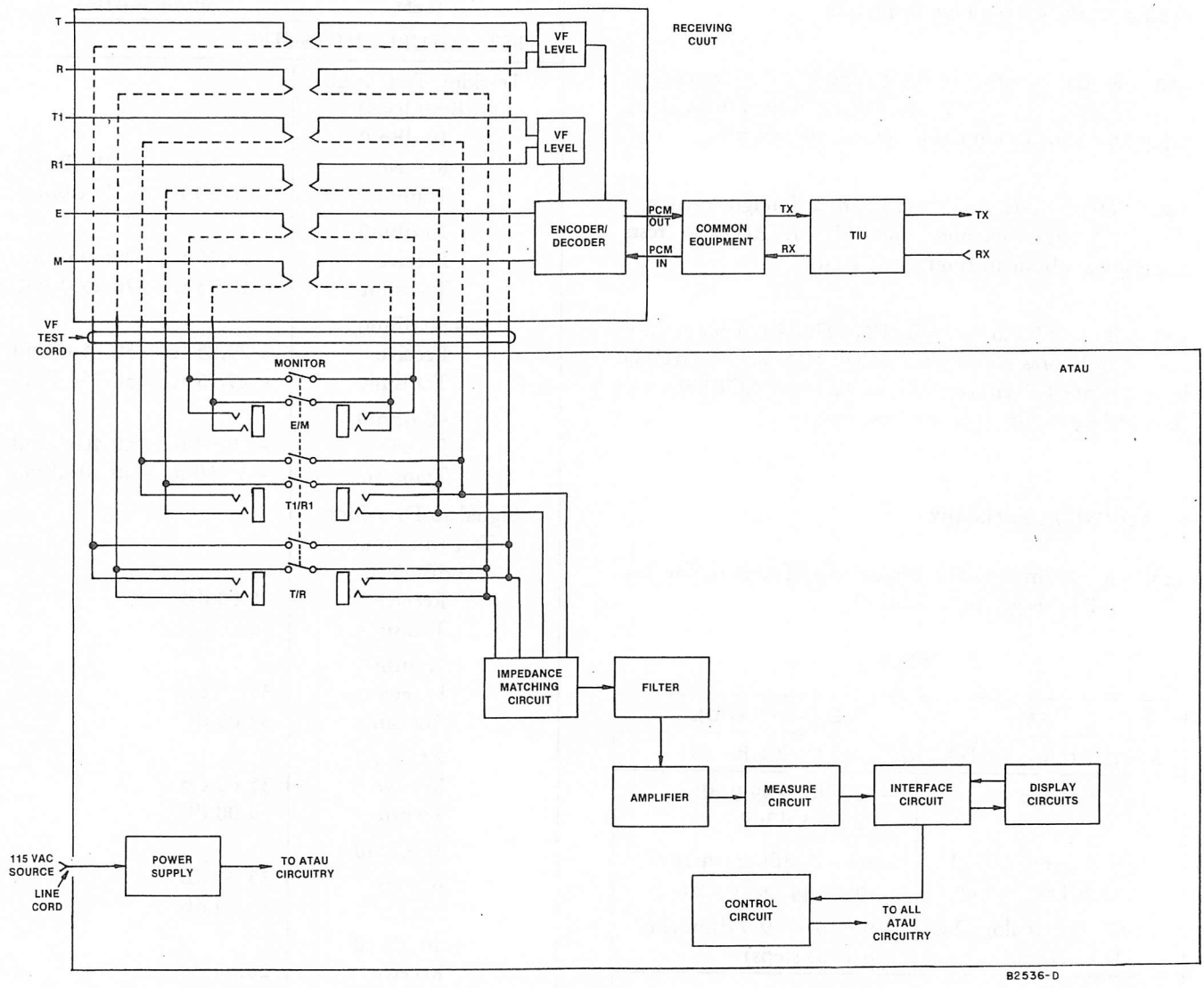

Fig. 8—Signal Flow for End-to-End Tests at Receiving End and for Crosstalk Test

5.04 The ATAU performs all single-ended tests in approximately one minute (total time) when operating in the automated mode. Table C provides a breakdown of the time required for each test. The maximum test time recommended to satisfy local practices per Section ITTR-18-443 is approximately 46 seconds (signaling, VF level, signal-to-distortion, and idle channel noise tests).

5.05 The ATAU will match the impedance of any commercially available channel unit.

5.06 Noise measurements performed by the ATAU utilize a true rms-to-dc converter to guarantee accuracy.

TABLE C

TEST	TIME (SEC)
Signaling Check (Channel Type Identification)	1
VF Level (Receive and Transmit)	2‡
Tracking (Receive and Transmit)	14
Signal-to-Distortion (Receive and Transmit)	39
Idle Channel Noise (Receive and Transmit)	4

‡Typical time, depending on user reading LEVEL meter and pressing STEP button (to continue test).

5.07 The ATAU makes all measurements in hundredths. The measurements are rounded to the nearest tenth before being displayed.

5.08 Remote control of the SELECT + / – switch and START and STEP buttons can be provided by using an optional hand-held remote control unit.

5.09 When testing signaling on a foreign exchange subscriber channel unit, the ATAU also tests ringing via a built-in ringing generator.

5.10 If the SIG and a TERMINATION button are not both pressed, or if the TERMINATION AUTO button is pressed without SIG, all TEST SELECT LEDs will flash indicating an improper test setup.

6. TECHNICAL SUMMARY

6.01 A summary of technical specifications for the ATAU is given in Table D.

TABLE D

ITEM	SPECIFICATION
MEASUREMENT TOLERANCES (ACCURACY)	
Meter Range	+12.0 to –99.9 dBm (±0.05 dBm)
1-kHz Digital Oscillator Level Range	0 to –40 dBm0 (in 10-dB steps approximately)
1020-Hz Analog Oscillator Level Range	+9.9 to –69.9 dBm (in 0.1-dB steps)
VF INTERFACE	
Input/Output Impedance	150, 600, or 1200 ohms (4-wire); or 600 or 900 ohms (2-wire)
Separation Between ATAU and D448 Multiplex Terminal	25.0 ft (7.6 m) maximum; cord supplied provides for 12.0 ft (3.7 m)
PCM INTERFACE	
Compatibility	D448 via TIU
Line Rate	1.544 Mb/s
PCM Startup Time	200 ms
Separation Between ATAU and D448 Multiplex Terminal	25.0 ft (7.6 m) maximum; cord supplied provides for 12.0 ft (3.7 m)

TABLE D (CONT)

ITEM	SPECIFICATION
TEST FAILURE LIMITS (TFL)	
Tracking Test (from 0-dBm0 level)	
–10 dBm0	
Receive	–9.71 to –10.21 dBm0
Transmit	–9.75 to –10.25 dBm0
–20 dBm0	
Receive	–19.70 to –20.20 dBm0
Transmit	–19.75 to –20.25 dBm0
–30 dBm0	
Receive	–29.85 to –30.35 dBm0
Transmit	–29.75 to –30.25 dBm0
–40 dBm0	
Receive	–39.40 to –40.40 dBm0
Transmit	–39.50 to –40.50 dBm0
Signal-to-Distortion Test (minimum)	
0 dBm0	
Receive	35.00 dB
Transmit	34.00 dB
–10 dBm0	
Receive	35.00 dB
Transmit	34.00 dB
–20 dBm0	
Receive	35.00 dB
Transmit	34.00 dB
–30 dBm0	
Receive	35.00 dB
Transmit	34.00 dB
–40 dBm0	
Receive	29.00 dB
Transmit	28.00 dB
Idle Channel Noise Test	
Receive	16.00 dBrnc0
Transmit	22.00 dBrnc0
AC POWER	
Voltage	110 Vac
Power	47W maximum
Line Cord	7.0 ft (2.1 m)
OPERATING ENVIRONMENT	
Temperature	0° to 55°C
Humidity	To 95% at 40°C (no condensation)
Altitude	To 14,000 ft (4,300 m)

TABLE D (CONT)

ITEM	SPECIFICATION
DIMENSIONS	
Height Width Depth	8.0 in. (20.3 cm) 12.0 in. (30.5 cm) 13.0 in. (33.0 cm)
WEIGHT	30.0 lb (13.6 kg)

7. REPLACEABLE PARTS

7.01 Field-replaceable parts for this unit are listed in Table E.

TABLE E

DESCRIPTION	QTY	ITT PART NO.
Fuse, Cartridge, 1A (F1)	1	600006-396-019
Line Cord	1	600092-102-001
PCM (ATAU-to-TIU) Test Cord	1	600371-707-001
VF (ATAU-to-CUUT) Test Cord	1	600397-540-001

8. REFERENCES

8.01 Engineering drawing No. 628450-000 was used in the preparation of this Section.

8.02 Related information on the ATAU may be found in Section ITTR-18-443, Channel Units — Single-Ended Transmission Tests.